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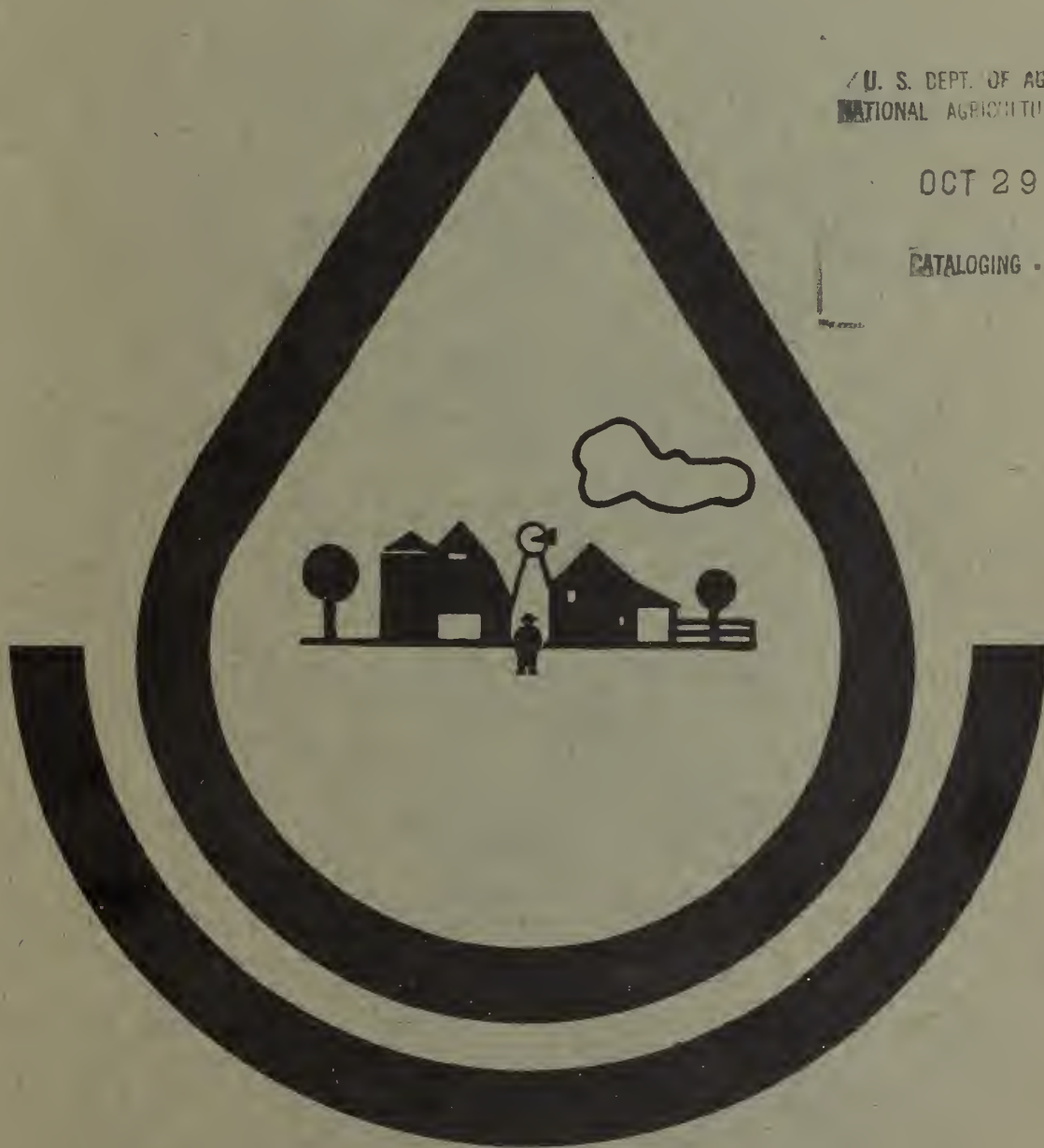
BEAR SWAMP WATERSHED WORK PLAN

Chowan and Perquimans Counties
North Carolina

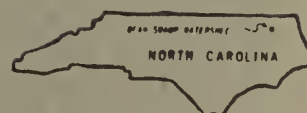
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ADDENDUM

Bear Swamp Watershed

Chowan and Perquimans Counties, North Carolina

This addendum is prepared to present information consistent with the intent of the Principles and Standards for Planning Water and Related Land Resources which became effective October 30, 1973. The information presented is: Part I - Benefit to Cost Comparisons; Part II - Abbreviated Four Account Displays; and Part III - Abbreviated Environmental Quality Plan.

PART I

The project costs, benefits, and benefit-cost ratio are based on a 6 1/8 percent interest rate, current normalized prices, and the 1975 price base. Annual project costs, annual benefits, and benefit-cost ratio are as follows:

1. Project costs \$ 37,355
2. Project benefits \$ 90,980
3. Benefit-cost ratio 2.4 to 1.0

PART II

Selected Plan NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

<u>Components</u>		<u>Measures of effects1/</u>	<u>Components</u>	<u>Measures of effects1/</u>
Beneficial effects:			Adverse effects:	
A.	The value to users of increased outputs of goods and services		A.	The value of resources required for a plan
1.	Flood prevention	\$26,915	1.	Multiple-purpose channel (17.3 miles)
2.	Drainage	23,565	a.	Project installation
3.	Utilization of unemployed and underemployed resources		b.	Project administration
	- project construction and operation and maintenance	5,025	c.	Operation and maintenance
Total beneficial effects		\$55,505	Total adverse effects	
			Net beneficial effects	

1/ Average annual

Date: May 1975

PART II

Selected Plan
REGIONAL DEVELOPMENT ACCOUNT

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

<u>Components</u>		<u>Measures of effects1/ Region2/ Rest of Nation</u>		<u>Measures of effects Region1/ Rest of Nation</u>	
A. Income:		A. Income:			
Beneficial effects:		Adverse effects:			
1. The value of increased output of goods and services to users residing in the region.		1. The value of resources contributed from within the region to achieve the outputs.			
a. Flood prevention	\$26,915	a. Multiple-purpose channel (17.3 miles)			
b. Drainage	23,565				
c. Utilization of unemployed and under-employed resources - project construction and operation and maintenance	5,025	Project installation (structural measures)	\$9,005	\$14,155	
d. Secondary	6,315	Project administration	160	2,615	
		Operation and maintenance	10,500		
Total beneficial effects	\$61,820	Total adverse effects	19,665	\$16,770	
		Net beneficial effects	\$42,155	- \$16,770	
B. Employment		B. Employment			
Beneficial effects:		Adverse effects:			
1. Increase in the number and types of jobs.		1. Decrease in the number and types of jobs	0	0	
a. Employment for project construction		Total adverse effects	0	0	
		Net beneficial effects	One permanent part-time semi-skilled job and six man-years of semi-skilled employment over the installation period (3 years).		
b. Employment for project operation and maintenance					
Total beneficial effects:					

PART II

Selected Plan
REGIONAL DEVELOPMENT ACCOUNT (Continued 2)

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Components

Measures of effects
Regionl/ Rest of Nation

C. Population Distribution

Beneficial effects

Create one permanent part
time semi-skilled job in a
rural area and six man-years
of semi-skilled employment
over the installation period
(3 years). _____

Averse effects _____

D. Regional Economic Base and Stability

Beneficial effects

Provide average annual flood
damage reduction and drainage
benefits valued at \$26,915 and
\$23,565, respectively in an area
where agriculture is the main
economic activity. Create one
permanent part-time semi-skilled
job and six man-years of common
labor employment over the install-
ation period (3 years). _____

Adverse effects _____

1/ Region consists of Chowan and Perquimans Counties, North Carolina

Date: May 1975

Selected Plan
ENVIRONMENTAL QUALITY ACCOUNT

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Components

Measures of Effects

Beneficial and adverse effects:

A. Areas of natural beauty.

1. Project output will make available regional funds and resources which will be used to enhance the physical appearance of 130 farms in the watershed.
2. Approximately 62 acres of forest-land will be converted to channel and spoil.
3. Thirty-one acres of forest land will be temporarily cleared for debris disposal.

B. Quality considerations of water and land resource.

1. Sediment entering channel will be reduced from 2,600 tons per year to 1,670 tons per year.
2. Flood damages will be reduced by 54 percent (crop and pasture land).
3. Transportation routes will be improved to reduced flooding.
4. Health conditions will be improved by elimination of mosquito breeding habitat and improved septic drain fields.

C. Biological resources and selected ecosystems.

1. There will be temporary damage to fishing resources during and immediately after construction.
2. Wildlife habitat between Secondary Road 1113 and Lateral 5 will be disrupted.

D. Irreversible or irretrievable commitments.

1. Approximately 62 acres of forest-land will be committed to spoil placement and channel use.
2. Approximately 10 acres of open land will be committed to spoil placement land channel use.
3. Labor, materials, energy for construction of project measures.

PART II
Selected Plan
SOCIAL WELL-BEING ACCOUNT

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Components

Measures of effects

Beneficial and adverse effects:

A. Real income distribution

1. Create one permanent part-time semi-skilled job and six man-years of semi-skilled employment over the installation period (3 years).
2. Create regional income benefit of \$61,820. The distribution of these benefits by income class is not readily available.

<u>Farm Gross Income Class</u> (dollars)	<u>Percentage of Adjusted Gross Income in Class1/</u>
---	---

Less than 3,000	5
3,000 - 10,000	14
More than 10,000	81

3. Local costs to be borne by region total 19,665 annually. The local costs will be provided by Chowan County Drainage District No. 3 but distribution of these benefits by income class is not readily available.

B. Life, health, and safety

1. Improve the usefulness and safety of transportation routes. Improve health conditions by improved septic drain fields and elimination of mosquito breeding habitat.

1/ Source: United States Department of Commerce, 1969 Census of Agriculture

PART III

Abbreviated Environmental Quality Plan

Bear Swamp Watershed Chowan and Perquimans Counties, North Carolina

The goals of this environmental quality plan for Bear Swamp Watershed are to preserve and enhance areas of natural beauty; maintain and improve the quality of the water, land and air resources; and preserve and enhance the biological resources, and ecosystems of the watershed so that man can live in an esthetically and culturally pleasing environment.

The principal environmental quality problems in the watershed are the deterioration of the native land and water resources associated with intensified agricultural use and high production costs and low quality crops caused by frequent flooding and inadequate outlets for on-farm drainage.

The watershed lies within a rural setting, typical of small watersheds in the lower coastal plain of North Carolina. The rim of the upper end of the watershed is in forest; while the middle upper area has been committed to crops, such as soybeans, corn, and peanuts. The lower third of the watershed has smaller tracts of agricultural land interspersed amid tracts of forestland. Edge-type wildlife habitat has been reduced in the agricultural area because of the farming practice of tilling up to the edge of the channel banks, especially on laterals. Erosion from these banks and road ditches is responsible for most of the sediment now being deposited in the channels. The main stream is accessible for fishing only at road crossings or by walking through the swamp.

Component needs for solving problems relating to specific environmental conditions are listed below:

1. Areas of Natural Beauty
 - a. Maintain a diversity of landscapes.
 - b. Reduce road ditch erosion.
 - c. Reduce road dust.
2. Quality of Water, Land, and Air Resources
 - a. Improve the quality of the stream flow of Bear Swamp by reducing sediment into the channel as a result of road ditch and channel bank erosion.
 - b. Maintain and enhance the productivity of the land resource base.
 - c. Improve the quality of the air by reducing the dust associated with dirt roads.
 - d. Increase use of the fishery resource.

3. Biological Resources and Ecosystems

- a. Provide more dependable food supplies for both upland game and wetland wildlife.
- b. Reduce damage to fishery habitat from sedimentation.
- c. Create additional cover for upland game habitat.

The plan elements for environmental quality consist of a system of management practices, land treatment measures, structural measures, and land acquisition.

Land treatment measures will be installed to assure future productivity of the cropland and to provide on-farm surface and subsurface drainage systems thereby insuring that benefits will be realized from the structural measures.

Approximately 17.3 miles of channel work would provide capacity for the five-year, 24-hour frequency runoff. It would also provide adequate outlets for crop and forest land. Design would include capacity with native vegetation reestablished thereby eliminating the need for disturbance of wildlife habitat from future maintenance procedures.

Sediment traps would be installed to assist in future maintenance and trap sediment from moving to the lower end of the watershed. Vegetated strips and wildlife food and cover planting would be installed alongside both sides at all channel work through cropland.

A maintenance travelway would be vegetated with wildlife plantings on either side for all channel work going through forestland. Debris cleared from rights-of-way would be removed from the work area where additional wildlife habitat would need to be cleared for disposal.

The channel would be made navigable for small fishing boats from the end of channel work to the outlet at Perquimans River.

A greentree reservoir area is included in the lower end of the watershed between Secondary Road 1111 and Secondary Road 1113. This would require a small earth dam and outlet structure above Secondary Road 1111. The structure would allow the reservoir to be flooded during winter months and permit passing flood flows and drainage during the agricultural growing season. The reservoir area would be owned by the county or drainage district and be managed by the North Carolina Wildlife Resources Commission for wetland habitat. Pipe inlets would be installed at all road crossings and then through the travelway to permit side drainage and reduce erosion. Cost of the above measures can be cost-shared from Public Law 566 funds.

Dirt roads would be paved to prevent dust and the need for maintenance after each storm, thereby destroying the vegetation on roadbanks. This would reduce sediment entering the channels.

The estimated installation costs of the elements of the environmental quality plan are as follows:

- | | | |
|----|---|-----------|
| 1. | Ninety-one thousand feet of channel work including vegetated strips, pipe inlets and wildlife plantings | \$416,000 |
| 2. | Land treatment measures | \$ 60,000 |
| 3. | Forestry treatment measures | \$196,000 |
| 4. | Greentree reservoir, including land rights | \$ 99,900 |
| 5. | Four and one-half miles of channel for fishing boats | \$ 15,500 |
| 6. | Boat ramp and parking lot | \$ 16,600 |
| 7. | Fifteen miles of paved roads | \$666,000 |

The total installation cost of the environmental quality plan is estimated to be \$1,470,000.

The environmental effects that would result from installation of the environmental plan are as follows:

1. Areas of Natural Beauty
 - a. Maintain the diversity of the landscape through the preservation and enhancement of the land resource base which sustains this diversity.
 - b. Enhance the scenic quality of the watershed by reducing roadbank erosion and road dust.
2. Quality of Water, Land, and Air Resources
 - a. Reduce flooding and provide adequate outlets for on-farm drainage for 6,630 acres of cropland and 800 acres of forestland.
 - b. Reduce potential for agricultural chemicals pollution in Bear Swamp.
 - c. Provide for additional upland habitat by increasing food and cover.
 - d. Provide for 350 acres of wildlife wetland habitat to be preserved and managed for wildlife benefit.
 - e. Reduce dust and associated pollution of air and adjoining vegetation along 15 miles of dirt roads.
 - f. Increase the use of the fishery resource by providing 4.5 miles of navigable channel, a boat ramp and a parking area.
3. Biological Resources and Selected Ecological Systems
 - a. Increase the wetland wildlife through management of the 350 acres of greentree reservoir.
 - b. Maintain and increase the upland habitat by providing food and cover along channel banks through cropland areas.
 - c. Increase the fishery resource by reducing sediment and chemical pollution reaching the Bear Swamp channel.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

About 93 acres of forestland (not including channel area) will be cleared, of which 54 acres will be converted to spoil placement and a maintenance travelway. Approximately eight acres will be committed to channels due to increased top widths over existing channels. The remaining 31 acres, used for debris disposal, will be allowed to revert to forestland after construction.

Of the channels in open land, two additional acres will be committed to permanent channels and eight acres converted to spoil placement and travelway.

The 350 acres of forestland required for the greentree reservoir will be permanently committed to this use.

Labor and materials needed for project installation will be permanently committed to flood prevention, agricultural water management, transportation, and wildlife habitat uses.

WATERSHED WORK PLAN

BEAR SWAMP WATERSHED

Chowan and Perquimans Counties, North Carolina

Prepared under the Authority of the Watershed
Protection and Flood Prevention Act (Public
Law 566, 83rd Congress, 68 Stat. 666) as amended.

Prepared by:

Albemarle Soil and Water Conservation District

Chowan County Drainage District No. 3

With assistance by:

United States Department of Agriculture, Soil Conservation Service

United States Department of Agriculture, Forest Service

December 1975

WATERSHED WORK PLAN AGREEMENT

between the

Albemarle Soil and Water Conservation District
Local Organization

Chowan County Drainage District No. 3
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of North Carolina

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Bear Swamp Watershed, State of North Carolina, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Bear Swamp Watershed, State of North Carolina, hereinafter, referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about four years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. Chowan County Drainage District No. 3 will acquire, with other than Public Law 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost: \$83,300.)
2. Chowan County Drainage District No. 3 assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the drainage district and the Service as follows:

	<u>Chowan County Drainage District No. 3</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation payments	59.7	40.3	\$01/

3. Chowan County Drainage District No. 3 will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs of structural measures to be paid by Chowan County Drainage District No. 3 and by the Service are as follows:

<u>Works of Improvement</u>	<u>Chowan County Drainage District No. 3</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
All structural measures	23.35	76.65	\$262,000

- 1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentage shown.

5. The percentages of the engineering costs to be borne by Chowan County Drainage District No. 3 and the Service are as follows:

<u>Works of Improvement</u>	<u>Chowan County Drainage District No. 3 (percent)</u>	<u>Service (percent)</u>	<u>Estimated Engineering Cost (dollars)</u>
All structural measures	0	100	\$26,200

6. Chowan County Drainage District No. 3 and the Service will each bear the costs of project administration which it incurs, estimated to be \$2,600 and \$41,900, respectively.
7. Albemarle Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
8. Albemarle Soil and Water Conservation District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
9. Chowan County Drainage District No. 3 will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
11. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.
13. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C. F. R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.
15. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Albemarle Soil and Water Conservation District
Local Organization

By: L. L. Brumby

Route 1, Edenton NC 27944
Address Zip Code

Title: Chairman

Date: March 9, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Albemarle Soil and Water Conservation District adopted at a meeting held on March 9, 1976.

M. B. Berry
Secretary, Local Organization

Route 1, Box 144, Elizabeth City NC 27909
Address Zip Code

Date: March 9, 1976

Chowan County Drainage District No. 3
Local Organization

By: Archie T. Lane Jr.

Route 1 Hertford NC
Address Zip Code

Title: Chairman

Date: February 27, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Chowan County Drainage District No. 3 adopted at a meeting held on February 27, 1976.

Robert P. Hallowell
Secretary, Local Organization

Route 1, Box 896, Hertford NC 27944
Address Zip Code

Date: February 27, 1976

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

James L. Hicks
State Conservationist

March 10, 1976
Date

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BEAR SWAMP WATERSHED

June 1975

SUMMARY OF PLAN

Bear Swamp Watershed is located in northeastern North Carolina approximately 10 miles north of Edenton. About one-third of the 20,300-acre drainage area is in Chowan County and the remaining area is in Perquimans County. The project will be sponsored by the Albemarle Soil and Water Conservation District and the Chowan County Drainage District No. 3.

Watershed problems include inadequate outlets for drainage of cropland and forestland; frequent flooding of cropland and roads; reduced channel capacities due to sediment deposition from channel banks and road ditches; and lack of upland game food and cover.

Land treatment measures, such as conservation cropping system, crop residue management, land smoothing, and surface and subsurface drains will be installed or applied for adequate treatment of 1,376 acres and partial treatment of 3,260 acres of cropland. Conservation measures on forestland, consisting of tree planting, harvest cutting, and stand improvement measures, will be applied on 1,500 acres. Approximately 30 acres of pasture will be treated.

Structural measures planned will provide flood damage protection from all storms up to the five-year, 24-hour frequency event as well as providing adequate outlets for internal drainage of 5,450 acres of cropland and 800 acres of forestland. These measures consist of 17.3 miles of channel work and one grade control structure. Classification of channel work consists of excavation on 0.2 miles of unmodified channel (N), 1.3 miles of new channel construction (O) and 15.5 miles of previously modified channel (M). The flow conditions of these streams prior to the project were 3.3 miles with perennial flow (Pr), 8.2 miles with intermittent flow (I) and 5.8 miles with ephemeral flow (E). The channel work will provide improved water management in a watershed that is 42 percent agricultural crop and pasture land and 57 percent forestland. Pipe inlets at road crossings will reduce sediment into channels and 17.3 miles of wildlife plantings will provide food and cover for wildlife habitat. Three sediment traps on the main channel will collect sediment during the construction period and assist in maintenance throughout the life of the project. Design of channels will permit bank cover to return and not be removed by maintenance. Temporary seeding of channel banks will protect them from erosion until native vegetation becomes established.

The total installation cost of structural measures has been estimated at \$416,000. Of this amount, Public Law 566 funds will furnish \$268,923, and other funds will provide \$147,077. In addition, the land treatment program is estimated to cost \$298,000.

Summary

Project installation is scheduled for a period of four years, with the structural measures being installed during the second and third years. Land treatment measures will be installed by individual landowners (with technical assistance by the Albemarle Soil and Water Conservation District and the North Carolina Division of Forest Resources) throughout the installation period, with the surface and subsurface drainage being accomplished in the fourth year after an adequate outlet has been provided. Structural measures will be the responsibility of the Chowan County Drainage District No. 3.

Land treatment measures will be maintained by landowners concerned in accordance with their individual soil and water conservation plan. Structural measures will be operated and maintained by the Chowan County Drainage District No. 3.

The estimated annual cost of operation and maintenance is \$10,500. The average annual benefits are \$61,820 compared to the average annual costs of \$36,435, giving a benefit-cost ratio of 1.7 to 1.0.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

Bear Swamp is located in the northeastern part of North Carolina. It covers an area of 20,300 acres, of which one-third is in Chowan County and two-thirds in Perquimans County. The center of the watershed is 10 miles north of Edenton (population 4,766) and five miles northwest of Hertford (population 2,023). It is fan-shaped, the larger area being in the headwaters. The main stream (Goodwin Creek) flows north for about two-thirds its length, then flows east to its confluence with the Perquimans River.

The watershed is in the Roanoke subregion (0301) of the South Atlantic Gulf Water Resource Region (Figure 1), as delineated by the Water Resources Council. This subregion, located in northern North Carolina and southern Virginia, extends from the mountains to the coast. Bear Swamp (Goodwin Creek) empties into Perquimans River approximately 20 miles upstream from Albemarle Sound. The physical features of the watershed are characteristic of the flat, lower coastal plain of the Roanoke subregion area which contains fertile farmland dependent upon adequate drainage. Elevations within the watershed vary from about 20 feet mean sea level in the headwaters to nearly sea level at the confluence with Perquimans River. Most of the land is nearly level. The headwaters area features a large forested area with poorly developed drainageways.

The average annual rainfall is about 49 inches and is well distributed throughout the year. Temperatures vary from an average high of 79 degrees Fahrenheit in July to an average low of 43 degrees Fahrenheit in January. An average growing season is 225 days, extending from the first of April to the middle of November.

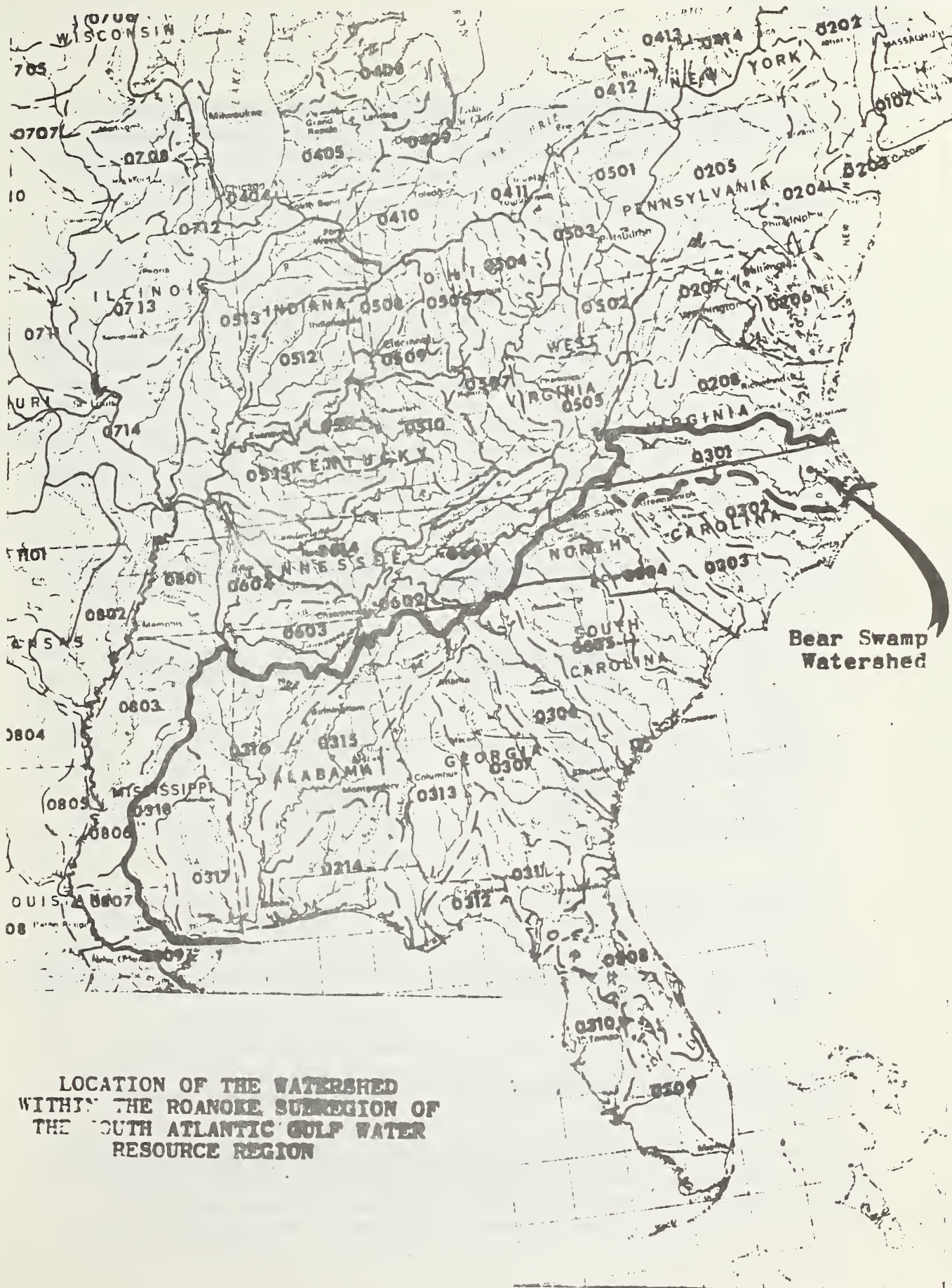


Figure 1

Resources

According to Ground Water Bulletin Number 10, published by the North Carolina Department of Water Resources, ground water containing less than 50 ppm of chloride is available from the water table and the upper Yorktown aquifer throughout most of Perquimans County. Objectionable amounts of other compounds causing "hard" water are present, however, and treatment is required before use.

Very little use is made of the surface water of the area. A small amount is used for livestock. Due to natural drainage sources in the swamp areas, the waters are usually low in dissolved oxygen and have a low pH. There are no major point-sources of pollution discharge and those pollutants associated with agricultural run-off are the only man-made detriments to water quality. The extent of the agriculturally related pollution has not been documented. The stream is classified by the North Carolina Office of Water and Air Resources as "C" - suitable for fishing and fish propagation, and other usage requiring waters of lower quality. Of the 17.3 miles of channel to be modified in the project, 3.3 miles are classified as having perennial flow, 8.2 miles as having intermittent flow, and 5.8 miles as having ephemeral flow.

Water samples taken at two stations in the watershed, though not representative, may provide some general idea of the conditions of the stream waters in the spring of 1974:

Substance Measured	Test Results	
	SR 1117	SR 1313
Alkalinity, Total (Mg/l)	30	20
Apparent color (units)	100	210
Hardness, Calcium (Mg/l)	30	30
Nitrogen, Nitrate (Mg/l)	0.3	0.25
Nitrogen, Nitrite (Mg/l)	0.0	0.0
Dissolved Oxygen (Mg/l)	9	9
pH	6.4	6.3
Phosphate, Total (Mg/l)	0.1	0.11
Turbidity (Jtu)	2	5

These samples were taken and analyzed by a Soil Conservation Biologist using a Hach model DR-EL Water Chemistry Kit.

Most of the soils in the watershed are classified in the Portsmouth, Hyde, Bladen, and Wahee series. Small areas on the ridges and adjacent to the more efficient drainageways are in the Altavista and Conetoe series.

These soils have been described and classified into certain capability groups. Capability grouping shows, in a general way, the suitability of soils for particular uses, the risk of damages or losses involved in their use, and the way they respond to treatment. For example, subclass

IIw indicates the soils have moderate limitations reducing the choice of plants because of wetness; subclass IIIw indicates severe limitations because of wetness; and subclass IIs indicates a moderate limitation because of a shallow, droughty or stony soil.

Portsmouth and Hyde soils have black loamy surface horizons with gray loamy subsoils and are very poorly drained. Most of these soils are in land capability subclass IIIw.

Altavista soils have fine loamy surface horizons and loamy subsoils. They are moderately well-drained and in capability subclass IIw. Conetoe soils have a thick sandy surface layer with a loamy subsoil. They are somewhat excessively drained and in the capability subclass of IIs.

The land capability class, as mentioned above, groups soils according to limitations for agricultural use; as indicated by the subclass and the reasons for these limitations.

There are 8,342 acres of cropland, 130 acres of pastureland, 203 acres in idle or miscellaneous uses, and 11,625 acres in forestland. Practically all land except for public roads is in private ownership. There have been about 7,125 acres of the forestland cleared of hardwood species.

These areas, largely in commercial or corporate ownership, are being converted to pine by site preparation work and tree planting. Small individually owned forest tracts will probably remain in wetland forest type. There are 350 acres of wooded swamp and bottom-land hardwood along the stream bank below Lateral 5, as classified by United States Department of Interior, United States Fish and Wildlife Service. According to their Circular 39, these 350 acres are Types 1 and 7 wetlands (see Fish and Wildlife Resources for further description).

Principal species include loblolly pine, pond pine, water oak, red oak, sweetgum, blackgum, hackberry, and beech.

Most of the cropland is in one large area from the headwaters of existing channels down to Lateral 5. In the upper reaches of this area (down to junction of Lateral 2 and the main), crops are planted up to the channel banks, thereby eliminating most native vegetation. Cropland below Lateral 5 is in smaller tracts interspersed with tracts of forestland. The vegetated edge begins on the main at Lateral 2 and gradually widens to 600-800 feet at Lateral 5.

All channels in the watershed on which work is proposed have been previously modified with the exception of (see Table 3 and project map): (A) the upper portion of Lateral 4 and the lower portion of Lateral 5 which presently have no well-defined channel, (B) the lower portion of Lateral 4A which now has an unmodified, well-defined channel.

Resources

Cover conditions of the watershed are good. Open lands are well managed with crop residue fully utilized. Forestlands have an excellent layer of humus which is effective in retarding runoff and controlling erosion.

The population of the watershed is estimated to be approximately 800. All of the population is classified as rural with small number being non-farm. There has been a great decline in farm population over the past 15 years. The publication, Profile of North Carolina Counties, shows that the area suffered a net outmigration of about four percent in 1967 alone. This is further indicated by the abandoned homes and farm buildings found throughout the watershed.

Economic Data

The 130 farms in the watershed, varying in size from a few acres to several hundred acres, average 115 acres. The majority are family-type farms; however, a few of the larger farms employ full-time hired labor. The average value per farm including buildings is approximately \$65,000. Crop and pasture land is valued at \$700 per acre while swamp forestland is valued at \$100 per acre. About 30 percent of the forestland is in several large tracts owned by timber companies and devoted to commercial timber production.

Land value and size of farms more than doubled in this area from 1954 to 1964, based on data contained in the United States Census of Agriculture. During the period 1964-1969 land values increased another 50 percent while the size of farms increased by 10 percent. The trend to larger operating units is expected to continue. About 60 percent of all farms in the watershed and about 45 percent of all commercial farms produced products with a gross value of less than \$10,000.

The major crops grown in the watershed are soybeans, peanuts, and corn. These crops account for approximately 80 percent of gross farm income. Present yields of these crops are: soybeans - 27 bu/ac; corn - 75 bu/ac; and peanuts - 2,300 lb/ac. Vegetable crops such as Irish potatoes and sweet corn are of minor importance; however, the acreage in these crops is expected to increase. Swine production is rapidly increasing in importance as indicated by the fact that sales have more than doubled since 1954. Farmers have found swine production to be a valuable means of increasing farm income.

Chowan and Perquimans Counties are in the Coastal Plain Regional Development Area, as designated under the Economic Development Act of 1965. This area is one of chronic unemployment and underemployment.

There are no railroads, United States highways, or North Carolina primary highways in the watershed. However, the watershed is served by a good network of secondary roads. They provide adequate access to markets.

There are no towns of 20,000+ population within 20 miles of the watershed. Edenton, a town of approximately 5,000 located 10 miles south, and Hertford, a town of approximately 2,000 located five miles southeast, serve the majority of the needs of the local people.

Fish and Wildlife Resources

Fishery resources in the lower reaches of Bear Swamp (Goodwin Creek) below Lateral 5 are considered good. The North Carolina Wildlife Resources Commission has classified the lower portion of the stream as largemouth bass and has reported that the stream provides "very good fishing for flier, warmouth, bluegill, and chain pickerel." Fish food organisms are plentiful as a sample taken revealed an average volume of 1.2 ml/ft² and an average number of 242/ft².

The upper reaches of Bear Swamp are classified as redbfin-warmouth by the North Carolina Wildlife Resources Commission. However, the upper half of the main channel (above Secondary Road 1110) and the tributary channels have insufficient base flow to support fish throughout the year. Portions of the channel between Secondary Road 1110 and Lateral 5 are sometimes used for herring spawning in the spring. The fishery resources in the previously channelized sections in the upper end of the stream and in the small tributaries are generally of low value. All channel work proposed in this project is on channels that have been previously modified or where there is now no existing channel with the exception of the lower end of Lateral 4A (see project map). Although this lateral is a natural unmodified channel it also has little or no fishery resource.

There are approximately 350 acres of Types 1 and 7 wetlands between Secondary Road 1113 (lower crossing) and Secondary Road 1111 (see project map). Additional areas of wooded swamps and seasonally flooded bottom lands extend on to the Perquimans River. In the vicinity of Secondary Road 1111 and below, wetland habitat is comprised mainly of cypress with a few tupelo gum and ash present. Going upstream the number of cypress becomes fewer with numbers of tupelo gum, ash, and oak increasing. Upstream from Lateral 5, ash and sycamore become the dominant tree species. The wet bottom lands provide habitat for waterfowl and escape areas for deer.

The uplands and agricultural lands adjacent to the stream in the upper portions of the watershed support populations of deer, small game, fur-bearing animals, and occasional waterfowl where farming practices have not eliminated cover.

Archaeological and Historic Values and Unique Scenic Areas

According to the National Register of Historic Places, there are no known places of historic value within the watershed. The North Carolina Department of Cultural Resources, Division of Archives and History, and the Research Laboratories of Anthropology at the University of North Carolina in Chapel Hill have no record of any places of historical or archaeological value or unique scenic areas being located in this area. The town of Edenton, located 10 miles south of the watershed, has several preserved houses built during the late 18th and early 19th centuries.

Recreational Resources

There are no organized recreational facilities within the watershed.

Fishing is generally limited to cane pole fishing at public roads where easy access can be obtained. Good fishing seems to be available but there are few points where boats can be launched so that fishing waters can be reached.

Waterfowl habitat is limited to the lower portion of the watershed and there is no significant hunting in this area. Deer hunting is limited almost entirely to the 1,000 acres of forestland which is leased to a private hunting club.

Soil, Water, and Plant Management Status

There are no clearly defined trends in change of land use within the watershed. It is expected that some of the present cropland will be put into crops such as vegetables that have a higher net return per acre. The timber companies will likely continue the conversion of their forestland to pines. The size of farms and fields is expected to continue to increase to accommodate the use of larger, more efficient equipment.

Soil and water conservation plans have been prepared for 99 farms, or 76 percent of the farms in the watershed. These plans cover 13,532 acres, or 67 percent of the watershed.

Soil surveys have been completed on about 14,550 acres. An additional 950 acres will need soil surveys during the installation period.

The North Carolina Division of Forest Resources, in cooperation with the United States Forest Service, is providing forest management assistance, forest fire prevention and suppression, distribution of planting stock, and forest pest control assistance to private landowners in the watershed area through the various federal-state cooperative forestry programs. The programs will be continued throughout the installation period of the project.

Some form of open ditch drainage has been installed on most of the 7,004 acres of wet cropland in the watershed. A small amount of tile has been installed in the last few years. Drainage is necessary to reduce production costs caused by the need for replanting, extra cultivation, and herbicides for weed control, and increase in harvest costs. Adequate outlets do not presently exist for on-farm drainage.

The Albemarle Soil and Water Conservation District, which covers this watershed, was chartered in 1943. One or more professional employees have been assigned by the Soil Conservation Service to each county since 1944.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment

Bear Swamp Watershed presents a problem that is typical of the lower coastal plains in North Carolina. It is located in an area that is intensively row cropped and the crops respond dramatically to good land management. They also suffer drastically without adequate drainage and protection from flooding.

There is a need to rearrange farm layouts into larger fields to facilitate more efficient use of larger-size equipment being used by farmers. To accomplish this, subsurface drains in combination with open ditches, need to be installed to the maximum extent practical. The relatively high annual rainfall necessitates some open ditches in cropland, regardless of the density of subsurface drainage systems. Vegetative measures such as conservation cropping systems, cover crops, and grasses and legumes in rotation are needed to improve and maintain soil productivity. Reforestation of understocked stands and proper forest management are needed to bring forestland into full production.

Floodwater Damages

Damaging floods usually occur in the watershed once or twice each year. Large infrequent floods occur on an average of every 10 to 15 years. An example of this type occurred in 1963 (see Figures 2 and 3). Damage estimates from this flood approached \$300,000. Presently the flooding and wet conditions affect an estimated 7,004 acres of cropland.

Flooding damages crops, pastures, roads, bridges, farm machinery, and farm improvements. It also delays planting, cultivating, and harvesting resulting in increased cost of production. Product quality is reduced further leading to reduced net income. In addition, flooding of roads and bridges results in safety hazards, temporary isolation of farms and inconvenient detours. It often makes schools, markets, and medical facilities inaccessible.

Existing channels cannot remove floodwaters from the cropland fast enough to prevent damages from floodwater originating from the forested areas. Drainage channels constructed in the large forested areas and emptying into existing channels add to water problems on farmland. During periods of excessive rainfall, overland flows from adjacent forestland areas in the upper part of the watershed further increase the flooding problem on crop and pasture lands. However, the swamp and channel below Lateral 5 do have adequate capacity and depth to remove the floodwaters once they reach this point. If the channels upstream from Lateral 5 were improved, the floodwater problems would be greatly reduced.

The larger floods cause pollution problems that cover large areas. Pollution from these floods is a serious health hazard to the nearly 800 people living in the watershed. These floods also endanger water supplies, prevent septic tanks from functioning properly, and produce large concentrations of mosquitoes that are vectors for malaria and encephalitis.

Average annual flood damages are estimated to be \$55,205, including indirect damages.



Field of young corn beside State Secondary Road 1312 flooded after a five to six-inch rain, June, 1963.



Field of young soybeans flooded after a five to six-inch rain, June, 1963. (Note crop residue that floated to the surface and was blown by the wind to the edge of the field.)



Lateral 1A at State Secondary Road 1312, Culvert and inadequate channel restricts flow.



Public road flooded by June, 1963, rain. Water is flowing from woodland (left) onto cropland (right).

Figure 3



Lateral 3 (Sta. 90 + 25) at State Secondary Road 1102 facing downstream.



Main (Sta. 247 + 50) at State Secondary Road 1110 facing upstream.

Figure 4



Main (Sta. 256 + 75) at State Secondary Road 1113 facing downstream.



Main near junction with Lateral 5 (Sta. 376 + 50) facing upstream.

Figure 5

Resource Problems

Erosion Damages

Gross erosion, as measured under present standards, is not a serious problem in the watershed. Cultivated fields are flat and sheet erosion is therefore negligible. Infiltration rates into the sandy soils, found around the western perimeter, are great enough to reduce velocity of runoff water so that it will not transport soil material. Soils in channel banks are largely sandy clay, clayey loam, and silty loam and are stable, with vegetation, under the velocities obtained in the low-gradient channels. Sources and amounts of gross erosion are indicated as follows:

<u>Land Use</u>	<u>Acres</u>	<u>Gross Erosion</u>	<u>Annual Total Tons/ac/yr</u>
Cropland and Pastureland	8,462	19,300	2.3
Forestland	11,618	3,500	0.3
Other (including roads)	203	430	2.1
Channel banks	<u>17</u>	<u>70</u>	4.1
Total	20,300	23,300	

An average annual erosion rate for the entire watershed would be 1.1 tons/acre/year.

Sediment Damages

There is an estimated 2,600 tons of sediment reaching the main channel and laterals annually. Approximately 1,040 tons (40 percent) of this is deposited in the channels and swamps above Lateral 5 (see project map). This sediment deposition reduces channel capacity, thereby increasing the frequency, depth, and duration of flooding. Below Lateral 5 the sediment has a larger swamp area to spread over. This area traps 1,535 tons of the remaining sediment. Approximately 25 tons per year, consisting of fine suspended particles, leaves Bear Swamp Watershed at an average annual concentration of one mg/l.

Drainage Problems

Soil types and subsurface drainage are the primary problems of water management. There are 7,004 acres of wet cropland and 130 acres of pastureland needing drainage for proper land use efficiency. This drainage includes both surface and subsurface on-farm and group drains. The outlets for these drains are provided by Bear Swamp main and laterals. At the present time efficient systems cannot be installed because of these outlets being inadequate.

These problems cause higher production costs by necessitating replanting operations, extra cultivations, extra herbicide and other chemical applications, and greater harvesting costs. The quality of the crop grown on wet soil is usually lower.

Drainage problems associated with the 6,500 acres of forestland within the watershed are realized at all levels of forest land management, from survival of seedlings to harvest and protection. Broadfoot and Williston (1973) found that tree regeneration, growth, and survival are adversely affected by prolonged flooding and/or sedimentation.

Management is also hampered by prolonged flooding. Management practices cover site preparation, planting, stand improvement work, harvest and protection between harvest rotations.

Drainage outlets are needed to allow movement and release of floodwaters, enhancing forest land production and also to facilitate access for proper management.

Recreation

Water-based recreation is limited to fishing and waterfowl hunting in the lower forested reaches of the main channel. Poor access and private ownership of the land limits the availability of the existing resources to the general public. The water quality is rated as "C" (see page 4). There is some upland game hunting such as deer and dove in the headwaters of the watershed.

The overall need for additional water-related recreational facilities is lessened because of the watershed's location of approximately 10 miles to access points on the Chowan and Perquimans Rivers and the Albemarle Sound. Being a farming area, the population of the watershed has been and is expected to continue to be fairly stable. The sponsoring local organization did not view recreational opportunities as a major problem in the watershed.

Fish and Wildlife

There are no existing problems which seriously affect the wildlife resources of the watershed. A lack of any existing or long-term management plans for the wildlife habitat and resources is the major threat. Edge habitat has also been reduced or eliminated along the channels through cropland. More wildlife enhancement practices such as the food and cover plantings to be used on the proposed channels would be beneficial.

Low base flow in the summer and fall becomes a limiting factor to fish populations in the upper reaches of the watershed streams.

Economic and Social

The watershed is in the Coastal Plain Regional Development Area.. This area is rated as having chronic unemployment and underemployment. Per capita income in 1970 was approximately \$2,200 and the unemployment rate was 7.1 percent. Approximately 10 percent of the larger farms employ full-time labor; however, the majority of the farms are family-type employing some seasonally hired labor during rush periods..

Resource Problems

Minority population of the watershed is estimated to be slightly less than 42 percent shown for Perquimans County is in the 1970 census.

Ground Water

There is sufficient ground water to meet present and anticipated future domestic and livestock water needs.

PROJECTS OF OTHER AGENCIES

There are no known existing or soon to be constructed works of improvement for water resource development which will affect or affected by works of improvement included in this plan.

PROJECT FORMULATION

Numerous public meetings have been held on Bear Swamp Watershed since local interest developed in the early 1960's. A formal application for assistance under the Public Law 566 program was submitted to the North Carolina Soil and Water Conservation Committee on November 22, 1965. After a field examination, in which interested individuals and representatives from other agencies were invited, the application was approved at the committee's regular meeting on January 5, 1966.

A preliminary investigation was made in 1967 by the Soil Conservation Service with assistance from representatives of the North Carolina Wildlife Resources Commission and the United States Fish and Wildlife Service and presented to the local people. The report of preliminary investigation included a description of existing habitat conditions and measures considered reasonable to provide for mitigation of damages by the proposed channel work.

Public hearings were held and drainage commissioners were elected. The proposed plan was approved for the project and the Service was asked by the chairman in a letter dated March 13, 1970, to "move forward in this program."

The objectives for the watershed project, as established by the sponsors, were to protect the land resource base of the watershed through a conservation land treatment program, provide adequate outlets (sufficient depth and capacity) for on-farm drainage systems on 5,450 acres of cropland and 800 acres of forestland and to prevent flood damages from all storms up to the five-year, 24-hour frequency storm.

A draft watershed work plan and environmental statement were prepared in 1971 and received a technical review.

Opposition to the 1971 draft was raised in the degree of influence on fish and wildlife resources that might be realized from construction below lateral 5. The proposed mitigative measures were questionable in lieu of the actual losses from construction below lateral 5. The Soil Conservation Service responded with a proposal to: (1) "terminate all channel work at lateral No. 5, (2) provide sediment traps at the junction of all major laterals and at the downstream termination point of the channel work, and (3) design main stream channel work with capacity to allow for natural vegetation to be re-established and uncontrolled." These measures would eliminate 3.3 miles of channel work on the lower end, 160 acres of wildlife wetland preservation, and 2.6 miles of peripheral channel with fishery development. Approximately 250 acres of cropland would be dropped from the benefited category. These proposed changes were discussed with the sponsors.

A field inspection was made November 14, 1973 in an effort to clarify specific details that had been noted in correspondence between the Soil Conservation Service; the Bureau of Sport Fisheries and Wildlife, the N. C. Wildlife Resources Commission and the sponsors. A meeting of representatives of these agencies was held on December 4, 1973 and an agreement reached to dispose of the cleared debris off the site and away from the swamp for the section of channel work between Secondary Road 1113 and lateral 5. Spoil placement was designed to assist the development of wildlife habitat in the area and one sided construction was proposed for channels with widths of 30 feet or less. Further correspondence among the parties exhibited mutual agreement with the finalized draft and evidenced the value of the interagency approach to resource planning.

The sponsors were kept abreast of all actions by the agencies and public meetings were held on May 30, 1973 and January 18, 1974, at which time the sponsors approved the present proposed plan.

Environmental Considerations

Concern was expressed in the early stages of planning for the fish and wildlife habitat located below Secondary Road 1110. The preliminary plan (as discussed above) was modified to eliminate work below Lateral 5. Thus, channel work will not go through the major portion of the habitat. Debris cleared from the rights-of-way will be removed from the swamp for the section between the lower crossing of Secondary Road 1113 and Lateral 5. This would avoid adverse effects to the habitat in this reach resulting from debris disposal.

Sediment traps will be installed on the main channel to trap sediment that otherwise might be detrimental to the habitat in the lower reaches. Filter strips will be seeded between cropland and channel banks to reduce the possibility of sediment or agricultural chemicals reaching the main channel.

Formulation

The main channel, from the junction with Lateral 2 downstream, will be designed for an aged condition that will provide needed capacity and depth without the need for continuous removal of bank vegetation. This decision was made to avoid any possible adverse effects to fish and wildlife habitat associated with removing bank cover during maintenance operations.

The spoil disposal area will be seeded and used as a maintenance travelway for removal of fallen trees or channel blocks throughout the maintenance period. Constructing a travelway in this fashion will avoid any clearing for maintenance in the future. Pipe inlets will be installed through the spoil to permit side drainage without erosion. A grade control structure will be installed on Lateral 5 to insure a stable channel.

Consideration was also given to ways to improving wildlife habitat during the course of the project. It was decided that wildlife plantings, suitable to provide some food and cover throughout the year, would be planted along the channel bank or spoil area the entire length of the project.

There is no anticipated displacement of people, businesses or farm operations by the installation of the works of improvement.

Alternatives

Land Treatment Only - Land treatment practices, such as conservation cropping systems, cover crops, and grasses and legumes in rotation, would improve and maintain soil productivity potential for future generations. Erosion is not a serious problem in this watershed.

Benefits from vegetative measures would reduce runoff, increase soil aeration, and provide wildlife food and cover.

Benefits on the 5,450 acres of wet cropland treated during the installation period could not be realized because of inadequate outlets for on-farm surface and subsurface drainage. Only 176 acres could be considered to be adequately treated of the 5,796 acres of the crop and pasture land remaining to be treated.

Water stagnation and adverse effects on seedling survival and tree growth on 6,500 acres of forestland continue. Good management practices would continually decline.

It is estimated that land treatment will provide flood damage reduction benefits of \$2,990 annually.

Installation cost of this alternative is estimated to be \$65,000 (\$4050 average annual) for crop and pasture land.

Channel Work and Floodwater Storage - This alternative includes 11.4 miles of channel work, 8.5 miles of dikes and land treatment as proposed by the planned project. The channel work would be performed on the laterals as proposed in the planned project. Dikes would be used to

make temporary (up to 10 days) floodwater storage areas of the forestland (4,400 acres) in the headwaters of Laterals 2, 2A, 3, 3A, 3B, and 4. (See project and problem location maps.) This would provide flood control on approximately 30 percent of the drainage area of the watershed. The channel work would provide for additional flood control and adequate outlets for on-farm drainage systems.

With this alternative the disruption of wildlife habitat between Secondary Road 1113 and Lateral 5 could be avoided. Temporary damage to the fishery resource during construction would be lessened since no work would be done on the main channel. Favorable environmental effects would be essentially the same as with the planned project. Average annual benefits of this alternative are estimated to be \$55,000.

Adverse effects would include 172 acres of forestland converted to spoil and debris disposal, channel widths and dikes. Approximately 60 acres of this used for debris disposal would be permitted to revert naturally to forest. Another 4,400 acres of forestland required for the floodwater storage areas would be committed to frequent temporary flooding. There would be some temporary damage to the fishery resource during and immediately after construction of the laterals.

The total cost of this alternative would be \$1,029,000 including land treatment cost of \$298,000 and installation cost of structural measures of \$731,000. In addition, an estimated \$10,000 would be required for annual operation and maintenance. The cost of structural measures plus operation and maintenance is equivalent to an average annual cost of \$55,570, (at 5 7/8 percent).

Flood Insurance with Flood Plain Zoning - This alternative would provide crop insurance for the present cropland, while at the same time zoning the Types 1 and 7 wetlands to insure they would not be cleared in the future. This would leave the watershed in its present state.

At the present time, only one crop in the watershed is considered of high value and insurable through the Federal Crop Insurance Corporation. In Chowan County, 60 percent of the peanuts can be insured under the "all risks" insurance; none in Perquimans County. No other crops are insurable in the watershed, due to the high probability of loss, as determined by the Corporation's Board of Directors. Crop insurance is on a self-paying basis, which means premiums must exceed payments by the amount of administrative costs. The high probability of damages occurring frequently makes crop insurance premiums too high to interest the farmers.

No Project - The no-project alternative would be one of present conditions under existing and projected trends. Any adverse effects to existing resources from stream channel work would be eliminated.

It is expected that the problems of flooding and inadequate drainage would progressively worsen on the 7,004 acres of wet cropland and pastureland as channels continued to be filled with sediment, debris, and waterweeds. Needed land treatment practices such as on-farm surface and subsurface drainage systems could not be installed to function efficiently because of

Alternatives

inadequate outlets. The farmers would be faced with continuing increasing production costs. The land will revert to a less intensive use as the inefficient factors of production cause the average-annual-net returns per acre of corn, soybeans, and peanuts to drop below the net returns from other uses such as trees. Net average annual benefits of \$28,375 would be foregone by leaving the watershed in its existing state.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures included in this plan were considered as the basic element in project formulation. They are necessary and justified to properly conserve, develop, and improve the agricultural land, and to assure the benefits used in justification of structural measures. Vegetative measures to be installed will consist of conservation cropping systems, cover crops, crop residue, minimum tillage, and grasses and legumes in rotation. Mechanical measures will consist mainly of tile and drainage mains and laterals.

Land treatment measures will be planned and applied in cooperation with the Albemarle Soil and Water Conservation District. Technical assistance for planning and installing of land treatment measures will be provided by the Soil Conservation Service through the soil and water conservation district and the U.S. Forest Service in cooperation with and through the North Carolina Forest Service.

Approximately 950 acres of soil surveys, requiring 21 man-days of survey time, will be needed during the project installation period.

As indicated in Table 1 of this plan, 1,376 acres of cropland and 30 acres of grassland will be adequately treated during the project installation period. Complete soil and water conservation plans will be prepared on 10 farms and six existing plans will be revised. The typical measures to be installed in order to achieve adequate treatment are defined as follows:

1. Conservation Cropping System: This system involves growing crops in combination with needed cultural and management measures. Cropping systems include rotations containing grasses and legumes as well as rotations achieving desired benefits without using such crops. This measure will improve or maintain good physical condition of the soil; protect the soil during periods when erosion usually occurs; help control weeds, insects, and diseases; and provide an economic return for farmers.
2. Crop Residue Use: By using plant residues in the plowing of leaves, stalks, and other plant remains back into the soil after the crop has been harvested, this measure improves growing conditions in the soil.
3. Minimum Tillage: This measure means limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. These limits retard deterioration of soil structure, reduce soil compactation and formation of tillage pans to improve soil aeration, permeability, and tilth.

4. Field Border: With this measure, a border or strip of perennial vegetation is established at the edge of a field by planting or by conversion from trees to herbaceous vegetation or shrubs. Purposes of a field border are to control erosion, protect edges of fields that are used as "turn rows" or travel lanes for farm machinery, reduce competition from adjacent woodland, provide wildlife food and cover, and improve the landscape.
5. Pasture and Hayland Planting: Such planting means establishing and reestablishing long-term stands or adapted species of perennial, biennial, or reseeding forage plants. (includes pasture and hayland renovation but does not include grassed waterway or outlet on cropland.) The purpose of this measure is to reduce erosion, to produce high quality forage, and to adjust land use.
6. Drainage Mains and Laterals: These consist of graded ditches installed to collect excess water within a field, lower the water table on areas having drainage problems, to serve as outlets for subsurface drains and to convey floodwater from the fields.
7. Land Smoothing: Land irregularities are removed with special equipment. Land smoothing improves surface drainage, provides for more effective use of precipitation, obtains uniform planting depths, provides for more uniform cultivation, improves equipment operation and efficiency, improves terrace alignment, and facilitates contour cultivation.

The Soil Conservation Service has predicted that 3,740 acres of cropland will receive partial conservation treatment. This will be in addition to the acres of crop and pasture land described above which will receive adequate treatment. Partially treated land has had one or more conservation measures applied to it, but it still needs other measures to be fully and adequately treated.

The following land treatment program on forestland was developed from a program of land treatment needs prepared by the United States Forest Service in cooperation with the North Carolina Division of Forest Resources, after a field survey of the watershed, and from land use recommendations by the Soil Conservation Service:

a. Tree Planting and Site Preparation (300 acres)

Reforestation of appropriate open land and understocked stands is necessary to bring this land into full production and return the fullest benefit to the landowners.

b. Forest Management (1,200 acres)

In order to realize the maximum benefits to the forestlands, it is necessary to put it under proper management. These management practices include intermediate and harvest cuttings, site preparation, and regeneration.

Improvement

Structural Measures

Structural works of improvement consist of approximately 17.3 miles of stream channel work and one grade control structure for flood prevention and drainage.

The planned channels will be constructed primarily in poorly graded sands (SP) and silty sands (SM), which contain enough clayey material to act as a binder. Soil profiles in all holes throughout the watershed are extremely similar. A representative profile shows 1.5-2.0 feet of a black SM (topsoil) overlying a dark gray SP-SM material. The SP-SM material in all holes is tight and compact in its undisturbed state. Some thin horizons (two to four inches thick) of clay (CL) were encountered within the SP-SM material. Based on an evaluation of the field performance of existing channels and the soils correlation data, it is concluded that there will be no major problems with bank or bottom stability as a result of the project.

Project channels are designed to remove runoff from cropland from all storms up to the five-year, 24-hour frequency storm within a period not to exceed 24 hours. It is possible that lands adjacent to the channel may still experience some flooding from storms of the five-year, 24-hour magnitude or less but removal of all floodwaters from this and smaller storms within the 24-hour period will prevent any damages to crops and pasture. Large infrequent storms will still cause some damage even with the improved channels but the decreased depth and duration of flooding from these storms will result in damages significantly less than under existing conditions. The depth of channels will be such that an adequate outlet will be assured for existing and future on-farm drainage systems.

A grade control structure will be required on Lateral 5 to flatten the gradient and insure a stable channel. Sand-cement bag riprap will be used to protect and stabilize the structure. Pipe inlets are planned to be installed, as needed, to allow surface water to enter the channels without serious erosion and to provide a travelway for maintenance. The travelway will not be continuous; however, access to all segments will be available from public roads. Small field ditches entering on the spoil side may require pipe inlets. These inlets are planned to be installed as a part of the project system. Spur ditches will be used for most ditches on the side opposite the spoil. Bituminized fiber or corrugated metal pipes are planned for the small pipe inlets except at public roads. Corrugated metal pipe is required for public roads to meet the North Carolina Department of Transportation and Highway Safety specifications.

New construction will follow existing channels. Spoil will be placed along both sides of the channel on the main downstream from Lateral 2, and on one side of the remaining channels. Special consideration will be given to occasionally leaving mast producing trees in the area to be cleared on the main channel below Lateral 2. The Soil Conservation Service biologist and engineer will cruise this area prior to construction to mark trees to be left. These trees will be located on

Improvement

the proposed channel bank at a minimum frequency of one per 200-400 feet and spoil will be placed so as to not to interfere with their future growth. In addition, a 20-foot section of native vegetation will be left on one side of the main channel both above and below each road crossing. These strips will be selected to give the maximum screening effect without interfering with water flow. Debris cleared from the construction area between Lateral 5 and the lower crossing of Secondary Road 1113 will be removed from the swamp to avoid destruction of prime wetland habitat.

The spoil adjacent to all channels will be shaped and seeded. Portions of the shaped spoil will serve as a maintenance travelway where the channel passes through forestland. Through the cropland it will be used as a "buffer strip" and sediment filter as well as a travelway. Filter strips, 15 feet wide, will be established on the side opposite the construction on these laterals to reduce sediment entering channels. Vegetation will also be established along the top of all channel banks and will consist of adapted trees, shrubs, grasses or legumes selected according to: characteristics of the particular site, maintenance requirements, wildlife benefits, and effectiveness in protecting channels and reducing maintenance costs. In addition to the vegetation established on the buffer strip and along the top of the channel banks, a three-foot strip of shrub lespedezea and autumn olive will be established along the outside of the buffer strip where used as a travelway through forested areas.

In selecting the plants to be used on the buffer strips and channel banks consideration will be given to selecting different plantings that will benefit wildlife species whose numbers are subject to seasonal oscillation due to food and cover being limiting factors. Planting of the different species, which will serve as food and cover during the different seasons, will be in alternate strips. For example, plantings for winter mast and stream-side shade will consist of sawtooth oak, pin oak, green ash, and willow oak.

Nine public and six private road crossings will require modification. These modifications include rock riprap, which will be used in lieu of modifying the bridge, to be placed at the upper crossing on Secondary Road 1113. Other modifications required are Secondary Road 1110 crossing at Laterals 4A, 4, 10, and 11; Secondary Road 1101 crossing at Lateral 3A; Secondary Road 1114 crossing at Lateral 5; Secondary Road 1312 crossing at Lateral 1A, and Secondary Road 1313 crossing at Lateral 2. These roads will be modified by lowering the elevation of existing pipes or by installing larger pipes.

Investigations have disclosed that the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown in the agreement.

Improvement

Channels are designed with sufficient capacity and depth below Lateral 2 (see project map) to eliminate the need for removal of the vegetation from the banks once it is reestablished. This will eliminate destroying wildlife cover, food, and shade in maintaining the channels.

Every reasonable effort will be made to control sediment production during construction. The major control measures will be: (1) over-digging 100-foot sections to serve as sediment traps immediately below major stream junctions; and (2) temporary seeding of spoil and channel banks as construction progresses upstream.

A study was contracted with the North Carolina Department of Cultural Resources, Division of Archives and History, to determine if any archaeological or scientific places are located in the watershed. No sites that would be affected by the project were documented in the study. The project construction contract will require that if any resources of this type are uncovered during construction work will be halted until they are evaluated.

EXPLANATION OF INSTALLATION COSTS

Total installation cost of the project is estimated to be \$714,000 (see Table 1). Public Law 566 funds will pay \$288,093 (40 percent) and other funds will provide \$425,907 (59.7 percent).

The estimated cost of the land treatment program is \$298,000. Of this amount, \$19,170 will be provided under authority of Public Law 566 and \$278,830 will be contributed by other funds.

The Soil Conservation Service will provide \$7,900 in accelerated technical assistance and \$5,500 under other going programs. Landowners and operators will provide the \$77,500 for the installation of conservation measures on their lands.

The estimated cost of the forestry land treatment program is \$207,100. Of this amount, \$11,270 are Public Law 566 funds, and \$195,830 are from other sources. The Public Law 566 funds are for accelerated technical assistance.

The North Carolina Division of Forest Resources will provide \$4,690 for accelerated technical assistance, in addition to the \$2,900 under the going Cooperative Forest Management Program, and a capital outlay of \$16,790 under the going Cooperative Forest Fire Control Program.

The landowners and operators will provide \$171,450 for their part of the Forest Land Treatment Program during the installation program. The industrial owners will provide the technical assistance needed to install the forestry measures on their lands.

Structural Measures

The construction cost of each structural measure is the estimated cost of all materials, labor, and equipment used. The costs are based on estimated quantities and the unit costs are based on recently installed watershed projects. Included in the construction cost is a contingency allowance of 15 percent to cover unforeseen items in construction. No unusual problems are anticipated.

Cost-sharing items of construction costs include 128,940 cubic yards of excavation - \$50,290; 145 acres of clearing - \$64,550; 170 pipe inlets - \$45,850; 63 acres of seeding of spoil - \$41,580; and 3.0 miles of channel work where costs are estimated on a per mile basis - \$16,320. The 15 percent contingency is in addition to the costs shown above.

Land rights include 193 acres of forest and 37 acres of open land valued at \$39,880; six private road crossings to be modified at a cost of \$21,300; and nine public road culverts and bridges to be modified at a cost of \$22,100.

Engineering services costs, which are estimated to be \$26,200, will be paid with Public Law 566 funds.

Project administration costs charged to Public Law 566 funds consist of construction inspection (\$26,200) and administration costs (\$15,700). Administration of contracts (\$2,600) is the only item charged to other funds.

Investigations have disclosed that the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown in the agreement.

The cost sharing of public road modifications to culverts and bridges is a negotiable item between the North Carolina Department of Transportation and Highway Safety and the drainage district.

All channel work was considered as multiple-purpose flood prevention and drainage. Non-wetland accounts for 6.6 percent of the benefited area, therefore this portion was allocated to flood prevention. The remaining 93.4 percent was considered as inseparable and was allocated equally. The resultant allocation is 53.3 percent to flood prevention and 46.7 percent to drainage. Of the construction cost, \$139,646 was allocated to flood prevention and \$122,354 to drainage.

Costs

The expected expenditures in accordance with the planned schedule of operation are as follows:

<u>LAND TREATMENT</u>		
<u>Year</u>	<u>P. L. 566 Funds</u>	<u>Other Funds</u>
First	\$ 4,800	\$ 69,710
Second	4,790	69,710
Third	4,790	69,710
Fourth	<u>4,790</u>	<u>69,700</u>
Total	19,170	\$278,830

<u>STRUCTURAL MEASURES</u>		
<u>Year</u>	<u>P. L. 566 Funds</u>	<u>Other Funds</u>
First	\$ 25,530	\$ 80,210
Second	219,760	65,670
Third	<u>23,633</u>	<u>1,197</u>
Total	\$268,923	\$147,077

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

The installation of the proposed works of improvement will directly benefit 5,450 acres of crop and pasture land and 800 acres of forestland on which monetary benefits were calculated. There will be 5,700 additional acres of forestland benefited either directly or indirectly (see project map). It has been estimated that 800 people will be benefited by the proposed structural measures.

The crop and pasture land on which benefits were claimed are subject to flooding from several sources: (1) runoff from pocosins and large forested areas; (2) accumulation of abnormally high precipitation; and (3) overflow from stream channels. The project, as designed will provide protection from all storms up to the five-year, 24-hour frequency event. Storms of greater magnitude than the five-year frequency will cause some flooding, but the reduction in degree and duration will abate a portion of the flood damages. It has been estimated that the proposed structural measures will yield a 54 percent reduction in damages to crop and pasture. The June, 1963, storm would have caused considerably less damage with the proposed project installed. Project channels will remove all runoff water from storms up to the five-year, 24-hour event within a period not to exceed 24 hours. This degree of protection is deemed satisfactory for crops produced in the watershed and will not encourage any significant land use changes.

There is expected to be no major change in the amount of gross erosion. As stated under Erosion Damages (page 14), the cropland has an average annual gross erosion rate of 2.3 tons per acre. This is well below the rate where damage would affect future productivity of the cropland. Erosion from channel banks will be reduced by preserving a vegetative strip between channel banks and the cropland.

Sediment from channel banks and road ditches is deposited directly into the channels. The filter strips alongside the cropland and pipe inlets will reduce the sediment going into the channels. The grade control structure will insure a stable channel for Lateral 5. Sediment traps will create collection points for the coarser particles of sediment to be removed from the channels. These traps are expected to trap 2,030 tons of sediment on an average annual basis during construction and an average of 920 tons annually after the channels have stabilized.

Sediment deposited in the swamp area between Lateral 5 and the Perquimans River is estimated to increase on an annual basis from 1,535 tons to 1,660 tons during construction and then decrease to 750 tons after channels have stabilized.

Effects

Land treatment measures on cropland, pastureland, and forestland are essential, along with the planned channel work, to produce the expected benefits. The planned land treatment measures will reduce the rate of runoff and provide on-farm drainage. The proposed forestry land treatment measures will improve the hydrologic condition, reduce sediment, and retard runoff. Good management and continued fire protection will increase the productivity of forestlands.

Agricultural Water Management

When complete, the project's proposed installation of tile and open drains will lower the water table in the upper soil profile on approximately 5,450 acres of crop and pasture land and 800 acres of forestland. This land will then be better suited for crops and forest because improved drainage permits better soil aeration, better root penetration, and hardier, more vigorous growth. As noted by many researchers, inadequate soil aeration is a primary inhibiting growth factor for plants on excessively wet soils (see Figure 4).

An additional 5,700 acres of wet forestland will be provided with adequate outlets. This will permit effective surface drains to be installed in the future. Increased seedling survival, tree growth, and access for management will occur. Hardwoods are expected to be retained in the same areas and can be more properly managed under project conditions.

Improved drainage also will decrease direct surface runoff through providing a more deeply drained soil profile with more capacity to absorb rainwater. This decrease in surface runoff will help to reduce the amount of fertilizers and insecticides lost in the runoff, especially those lost from initial impacts of precipitation.

Health and sanitation conditions will also be improved. Pollution from overflow of home sewage disposal facilities will be reduced. Reduction of the danger of polluted domestic water supplies is especially significant. The mosquito population will be reduced by elimination of some breeding places, thereby reducing the danger of malaria and encephalitis.

Decreased pollution from point and non-point sources and sustained low flow during dry periods should be realized as a result of the project and no degradation in the "C" classification is expected.

There is expected to be 400 acres of forestland converted to cropland as a result of the project. No other significant changes in land use or crop acreages is anticipated. Local producers do expect improved quality resulting in higher prices and lower production and harvest costs with the adequate drainage.

The flood stage and peak discharge in the reaches below Lateral 5 will be increased slightly after the project is installed. The increase in stage and discharge for the five-year storm will be about .25-foot and 210 cubic feet per second respectively. For the 100-year storm the stage increase would be about .5-foot and the peak discharge would be increased by about 500 cubic feet per second. No project-induced damages will be experienced in these reaches, however, because the wide

swamp in the lower part of the watershed provides ample flowage area for any increases in flow.

Fish and Wildlife and Recreation

The wetland habitat of greater value, located in the lower end of the watershed, will not be disturbed. There will be habitat of lower quality located from Lateral 5 upstream to Secondary Road 1110 cleared for channel work. There will be 93 acres of forestland cleared for additional channel width, spoil placement, and debris disposal. Thirty-one acres in debris disposal areas will revert to forestland in the future. Debris cleared from the construction area between Lateral 5 and the lower crossing of Secondary Road 1113 will be removed from the swamp to avoid destruction of prime wetland habitat.

There will be some damage to the fishery resources during and immediately after construction. The principal fishery is located below the end of construction; therefore, damage would be from possible temperature increases and the slight increase in sediment during construction. Also spawning areas for anadromous fish could be slightly damaged further upstream to Secondary Road 1110.

The design of the channels will permit native vegetation to return and remain, along with wildlife plantings made during the construction period. This will prevent further disruption of the fishery resources once they have recovered. The filter strips will reduce the possibility of agricultural chemicals from entering the streams.

Archaeological, Historic and Scientific

No known existing archaeological, historic, or scientific resource will be affected by the project. The project construction contract will require that if any resources of this type are uncovered during construction, work will be halted until they are evaluated.

Economic and Social

Employment opportunities will be created for the unemployed and underemployed during construction and in the operation and maintenance of the project. This will result in increased economic activity for the area's depressed economy by employing an idle factor of production (labor).

Secondary benefits will accrue as a result of increased income from transporting, processing, and marketing of increased farm production resulting from the project and from supplying additional materials to farmers.

It was estimated that floodwater damages to roads and bridges will be reduced 75 percent with the project installed. With reduced damages, school buses and mail delivery will encounter less delays and detours. More dependable transportation facilities will make medical help, facilities, and markets more accessible to the people of the watershed.

PROJECT BENEFITS

The estimated average annual floodwater and indirect damages reduction benefits (see Table 5) in the watershed are \$29,905 including annual benefits as follows: crop and pasture - \$26,895, roads and bridges - \$290, and indirect - \$2,720. Land treatment measures account for \$2,990 and structural measures account for \$26,915 of the flood reduction benefits (see Table 6).

Drainage benefits are estimated to be \$23,565 annually. These benefits accrue from reduced cost of production, increased price received per unit as a result of better quality, and a small increase in units of production on pastureland.

Average annual secondary benefits are estimated to be \$6,315. These benefits will accrue to processors, handlers, and local businesses in the immediate area as a result of increased farm income. Additional secondary benefits of a more intangible nature are expected to accrue outside the immediate area of influence of the project, and will stem from increased income which will place increased capital into circulation. These benefits will accrue to beneficiaries not readily identifiable and are considered to be more in the nature of benefits to the public in general. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

Annual redevelopment benefits are estimated to be \$5,025. These benefits result from the income provided to unemployed and underemployed labor and other resources during the construction and the operation and maintenance of the project. The installation of this project will contribute to the alleviation of unemployment and underemployment in this area.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the planned structural works of improvement, including operation and maintenance, is estimated to be \$36,435. Estimated average annual project benefits are \$61,820. The ratio of benefits to cost is 1.7 to 1.0 (see Table 6). The benefit-cost ratio without local secondary benefits is estimated to be 1.5 to 1.0.

PROJECT INSTALLATION

The installation period of the project is four years.

Landowners will install the planned land treatment measures in accordance with provisions of their individual conservation plans and agreements with the Albemarle Soil and Water Conservation District.

Technical assistance, including needed soil surveys, will be provided by the Service through the soil and water conservation district program. The present rate of assistance will be supplemented under provisions of Public Law 566 to accelerate planning and application of land treatment measures so the project can be completed during the four-year installation period.

Forest landowners will be encouraged to apply and maintain the forestry measures on their lands. The United States Forest Service will cooperate with and through the North Carolina Division of Forest Resources to provide technical

Installation

assistance in the planning and application of forestry land treatment measure in the watershed. A forester will be assigned to the project to assist landowners in the installation of the planned measures.

Structural works of improvement are scheduled during the second and third project years. All construction work will be let in one contract. Temporary seeding of channel banks will follow each day's construction. Shaping and seeding of spoil (including wildlife planting) will be completed by sections as quickly as practical after construction is complete and this work item will be an integral part of the construction contract.

The Service will advise the Secretary of the Interior through the Director, Southeast Region, National Park Service and the State Historic preservation office if any discoveries are made of historical or archaeological value. Construction will be halted upon such discovery until the area can be evaluated.

All land rights necessary for the installation of planned works of improvement will be secured by the Chowan County Drainage District No. 3, prior to the issuance of invitation to bid for construction. Water rights are not involved in this project under existing North Carolina law.

Structural work of improvement will be installed by Chowan County Drainage District No. 3. All items of construction except pipes, culverts, and bridges installed or modified on public roads will be performed under contracts let, administered, and financed by the drainage district. It will negotiate with the North Carolina Department of Transportation and Highway Safety for changes to be made to culverts and bridges on public roads. Pipes and culverts for ingress and egress on public road rights-of-way will equal the requirements of the Department of Transportation and Highway Safety and the Service.

The Soil Conservation Service and the sponsors will obtain, if needed, any permits applicable under Section 404 of the Federal Water Pollution Control Act Amendments of 1972. Project design is such as to maximize prevention of the discharge of dredge or fill material and the washing into the stream of spoil, etc., deposited on the banks. Permits, if required, will be obtained from the Environmental Protection Agency or the United States Army, Corps of Engineers, prior to construction.

Chowan County Drainage District No. 3 will develop and maintain a financial management system that will provide for disclosure of the financial results of each Public law 566 undertaking in which the Soil Conservation Service has a financial interest in accordance with Soil Conservation Service reporting requirements.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement on non-federal land, as described in this plan, will be provided under authority of the Watershed Protection and Flood Prevention Act, Public Law 566 (83rd Congress, 68 Stat. 666), as amended. This assistance is contingent upon the availability of funds appropriated for this purpose.

Chowan County Drainage District No. 3 embraces the entire area of the watershed.

Installation

Land Treatment

Land treatment measures will be installed by landowners or operators utilizing whatever cost sharing is available from other funds. Technical assistance provided to the soil and water conservation district under Public Law 46 will be continued at the present rate. Accelerated technical assistance to plan and install land treatment measures will be provided by the Service from Public Law 566 funds. The Rural Environmental Conservation Program is also available to landowners as a source of cost sharing for land treatment measures.

Technical assistance for the accelerated installation of forestry land treatment measures will be provided from Public Law 566 funds. The going Cooperative Forest Management Program will be continued. A capital outlay will be made from cooperative forest fire control funds to improve the quality of fire protection. Landowners and operators will install forestry land treatment measures on their own land utilizing any available funds from other going programs.

Structural Measures

All funds necessary to cover organizational operation expenses, land rights costs, cost of administering contracts, and the local organization's share of the construction cost will be furnished by the Chowan County Drainage District No. 3. This organization has the power of assessment and eminent domain which will be used as necessary to carry out the organization's responsibilities and to pay the local share of project cost.

Prior to entering into agreements that obligate funds of the Service, the Chowan County Drainage District No. 3 will have a financial management system for control, accountability, and disclosure of PL-566 funds received, and for control and accountability for property and other assets purchased with PL-566 funds.

Program income earned during the grant period will be reported on the sponsors' request for advance or reimbursement from the Service.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment

Land treatment measures will be maintained by individual landowners under provisions of their soil and water conservation plans. Forestry land treatment measures will be maintained by landowners under agreement with the Albemarle Soil and Water Conservation District. The North Carolina Division of Forest Resources will continue to furnish forest management assistance through the going Cooperative Forest Management Program and fire control activities through the going Cooperative Forest Fire Control Program.

The Albemarle Soil and Water Conservation District supervisors will make an annual inspection of the land treatment (including forestry measures) to determine the status of maintenance. A report of their findings and actions taken will be prepared and a copy provided to the Service representative. Special emphasis will be placed on areas that are found to be in need of additional protection.

Structural Measures

Structural measures to be maintained consist of 17.3 miles of stream channel work and one grade control structure. Maintenance will be performed by the Chowan County Drainage District No. 3. The district will make assessment on the benefited land to provide funds for carrying out maintenance. The cost of maintenance is estimated to be \$10,500 annually. Funds for three years of maintenance will be in hand at time of letting the contract.

Channel designs are based on aged conditions and there is a possibility of damage due to erosion of the channels while vegetation is being established. The risk of damage will be lessened by the temporary seeding of all exposed areas immediately following construction. A period of one growing season will be provided to establish permanent vegetation. During this period, any damage occurring because of erosion will be repaired and cost-shared between the Service and the local sponsors in the same ratio as the original construction.

Maintenance of stream channel work will consist of, but not be limited to the following:

1. Removal of debris from channels following major storms.
2. Control of undesirable growth in and adjacent to channels.
3. Control of aquatic plants in channel bottoms.
4. Removal of sediment from sediment traps.
5. Repair or replacement of pipes and bridges.
6. Management of vegetation on rights-of-way.
7. Removal of debris from pipes through spoil.

The Service and the sponsors will make a joint inspection annually, or after unusually severe storms, following installation of works of improvement.

Specific agreements for the maintenance of structural works of improvement will be executed prior to the issuance of invitations to bid. This agreement will cover such items as source of funds, methods of providing maintenance, annual maintenance inspections, and the responsibility for providing these funds and services.

The North Carolina Watershed Operation and Maintenance Handbook will be referenced to prepare an operation and maintenance plan for each structural measure.

The operation and maintenance agreements will contain specific provisions for retention and disposal of real and personal property acquired in whole or in part with Public Law 566 funds.



TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Installation Cost Item	Unit	Number		Estimated Cost (Dollars)1//									
		Fed. Land	Non-Fed. Land	P. L. 566 Funds				Other					
				Federal Land SCS3/	Non-Fed. Land SCS3/	Total SCS3/	Total	Federal Land SCS3/	Non-Fed. Land SCS3/	Total FS3/	Total		
LAND TREATMENT													
Land Areas2// Cropland	Acres to be treated	1,376	1,376							73,000		73,000	73,000
Pastureland		30	30							4,500		4,500	4,500
Forestland		1,500	1,500								171,450	171,450	171,450
Individual Practices such as Fire Control													
Technical Assistance						7,900	11,270	19,170		5,500		16,790	16,790
TOTAL LAND TREATMENT						7,900	11,270	19,170		83,000	195,830	278,830	298,000
STRUCTURAL MEASURES													
Construction													
Floodwater Retarding Struct.													
Multiple Purpose Structures													
Channel Modification4//													
(N)		0.2	0.2			2,310		2,310		700		700	3,010
(M)	mi.	15.8	15.8			183,630		183,630		55,972		55,972	239,602
(O)		1.3	1.3			13,183		13,183		3985		3985	17,168
Grade Control Structure	no.	1	1			1,700		1,700		520		520	2,220
Subtotal - Construction						200,823		200,823		61,177		61,177	262,000
Engineering Services						26,200		26,200					26,200
Project Administration													
Construction Inspection						26,200		26,200					26,200
Other						15,700		15,700		2,600		2,600	18,300
Subtotal - Administration						41,900		41,900		2,600		2,600	44,500
Other Costs													
Land Rights										83,300		83,300	83,300
Subtotal - Other										83,300		83,300	83,300
TOTAL STRUCTURAL MEASURES						268,923		268,923		147,077		147,077	416,000
TOTAL PROJECT													
						276,823	11,270	288,093		230,077	195,830	425,907	714,000

1/ Price base 1975

2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

3/ Federal agency responsible for assisting in installation of works of improvement.

4/ Type of channel before project: (N) - an unmodified, well defined natural channel or stream;

(M) - manmade ditch or previously modified channel; (O) - none or practically no defined channel.

Date: May 1975

TABLE 1A -STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Measures	: Unit :	: Applied to Date :	: Total Cost (Dollars) <u>1/</u> :
Conservation Cropping System	Acre	5,664	16,990
Crop Residue Management	Acre	4,000	12,000
Field Border	Feet	33,500	3,015
Minimum Tillage	Acre	8	40
Land Smoothing	Acre	100	2,000
Drainage Main or Lateral	Feet	225,800	45,160
Drain	Feet	62,090	27,940
Pastureland and Hayland Planting	Acre	130	5,330
Wildlife Habitat Management	Acre	1	60
Pond	No.	8	4,800
Tree Planting	Acre	750	59,000
TOTAL			176,335

1/ Price base: 1973

Date: MAY 1975

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

(DOLLARS) 1/

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds			Total	
	Construction	Engineering	Total	Construction	Land Rights	Other	Installation	Cost
STREAM CHANNEL WORK								
Main	90395	11800	102195	27535	29760	57295	159490	
Lateral 1	9455	1230	10685	2880	3145	6025	16710	
Lateral 1A	3575	465	4040	1085	3245	4330	8370	
Lateral 2	12825	1675	14500	3910	8175	12085	26585	
Lateral 2A	6550	855	7405	2000	1845	3845	11250	
Lateral 3	25100	3280	28380	7650	13540	21190	49570	
Lateral 3A	5330	695	6025	1620	2460	4080	10105	
Lateral 3B	1990	260	2250	605	405	1010	3260	
Lateral 4	11080	1445	12525	3375	3260	6635	19160	
Lateral 4A	9820	1280	11100	2990	2895	5885	16985	
Lateral 4A	1965	255	2220	600	1685	2285	4505	
Lateral 4A	2310	300	2610	700	1980	2680	5290	
Lateral 5	3795	510	4305	1190	2930	4120	8425	
Lateral 5	2103	260	2363	610	1505	2115	4478	
Lateral 7	4185	550	4735	1277	1095	2372	7107	
Lateral 10	4275	555	4830	1300	3430	4730	9560	
Lateral 11	4370	565	4935	1330	1945	3275	8210	
Grade Control Structure	1700	230	1920	520	-	520	2440	
SubTotal	200,823	26200	227023	61177	833003/	144477	371500	
Project Administration	--	--	41900	--	--	2600	44500	
GRAND TOTAL	200,823	26200	268923	61177	83300	147077	416,000	

1/ Price base: May 1975

2/ Type of channel before project: (N) an unmodified, well-defined natural channel or stream;
(M) manmade ditch or previously modified channel;
(O) none or practically no defined channel.

3/ Includes \$22,100 for public road modification and \$21,300 for private road modification.

Date: May 1975

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

(Dollars) 1/

Item	COST ALLOCATION		:		COST		SHARING		
	PURPOSE		:		P. L. 566		OTHER		
	Flood	:	Flood	:	Flood	:	Flood	:	
	Prevention:Drainage: Total	:	Prevention :Drainage: Total	:	Prevention :Drainage: Total	:	Prevention:Drainage: Total	:	
Multiple-purpose Channel	196,710	172,350	396,060	152,311	72,791	225,102	44,399	99,559	143,958
Grade Control Structure	1,300	1,140	2,440	1,300	621	1,921	-	519	519
TOTAL	198,010	173,490	371,500	153,611	73,412	227,023	44,399	100,078	144,477

1/ Price base: 1975

Date: MAY 1975

TABLE 3 - STRUCTURAL DATA
CHANNELS

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Channel (No. or Name)	Sta.	Sta.	Sta.	Drainage Area Sg. Mi.	Capacity cfs	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Depth (ft)	1/ "n" Value	2/ Velocity Aged As Built fps	3/ Excava- tion Cu, Yds.	Type of Work	Before Project Type of Flow Channel Condition
Bear Swamp Main Lateral	66+00 141+25 200+50 226+25 286+75 328+25	141+25 200+50 226+25 286+75 328+25	2.0 5.2 12.7 14.0 18.6 20.0	92 207 502 502 594 640	100 222 502 502 599 637	11.73 10.54 10.15 9.45 8.95 8.37	.00042 .00020 .00015 .00012 .00012 .00012	8 18 43 46 46 49	.040 .040 .040 .040 .040 .040	1.57 1.54 1.43 1.31 1.39 1.40	2.62 1.97 1.78 1.60 1.60 1.51	II II II II II II	M(U) M(U) M(U) M(U) M(U) M(U)
Lateral 1	55+00 77+25	77+25 115+50	0.6 1.5	32 75	94 80	13.33 11.80	.00120 .00040	4 6	.045 .040	2.08 1.45	3.10 2.46	II II	M(U) M(U)
Lateral 1A	50+00	73+25	0.7	38	77	13.40	.00080	4	.045	1.71	2.74	II	M(U)
Lateral 2	50+00 105+25 119+25	105+25 119+25 127+50	2.6 3.4 7.0	117 145 295	128 151 296	11.53 11.07 10.80	.00033 .00033 .00033	10 10 16	.040 .040 .035	1.51 1.57 2.02	2.49 2.41 2.48	II II II	M(U) M(U) M(U)
Lateral 2A	50+00	87+50	0.8	42	47	11.57	.00030	4	.045	1.05	1.93	II	M(U)
Lateral 3	50+00 86+00 120+00 140+75 148+75	86+00 120+00 140+75 175+00	1.9 2.8 2.8 3.6	101 125 125 150	111 136 121 141	13.78 11.98 11.52 11.10	.00077 .00053 .00016 .00016	6 10 12 12	.040 .040 .040 .040	2.02 1.81 1.12 1.18	3.24 2.88 1.81 1.81	II II II II	M(U) M(U) M(U) M(U)
Lateral 3A	50+00	79+00	0.6	32	59	11.60	.00048	4	.045	1.32	2.17	II	M(U)
Lateral 3B	50+00	63+00	0.3	22	61	13.80	.00050	4	.045	1.35	2.03	II	M(U)
Lateral 4	50+00 86+75 104+75 148+75	86+75 104+75 148+75 154+00	2.8 3.1 3.4 3.8	121 132 145 163	121 141 183 183	13.00 12.46 10.28 10.00	.00030 .00030 .00050 .00050	8 8 8 8	.040 .040 .040 .040	1.44 1.50 1.94 1.94	2.00 2.11 2.44 2.44	I I I I	O O M(U) M(U)
Lateral 4A	50+00 60+75	60+75 73+25	0.4 0.4	22 25	121 121	13.38 11.00	.00190 .00190	4 4	.045 .045	2.64 2.64	3.32 3.41	II I	M(U) N

TABLE 3 - STRUCTURAL DATA (continued)

CHANNELS

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Channel (No. or Name)	Sta. for Reach	Drainage Area	Capacity cfs	Water : Surface : Desig. Elev. :	Hydraulic Gradient : (ft/ft)	Channel Dim. Bottom : Depth : (ft) : (ft)	"n" Value	Age	Velocity Aged : As Built : fps : fps	Excava- tion : Cu, Yds. :	Type of : Work :	Before Project Type of : Channel :	Flow Condition
Lateral 5	50+00 72+50	1.5	74	12.53	.0010	4	5	.045	1.91	2.25	I	M(U)	I
	72+50 84+00	1.6	76	10.00	.0022	4	5	.045	2.83	3.21	I	O	I
Lateral 7	50+00 78+75	0.5	31	10.60	.00070	4	5.0	.045	1.60	2.49	II	M(U)	E
Lateral 10	50+00 73+25	0.3	20	11.20	.00110	4	5.0	.045	2.00	2.61	II	M(U)	E
Lateral 11	50+00 72+50	0.7	37	12.00	.00080	4	5.0	.045	1.71	2.74	II	M(U)	E

1/ All side slopes are 1:1

2/ As built "n" value = .025 for all channels.

3/ As built velocities taken at bank full or 10-year peak, whichever is smaller.

4/ I - Establishment of new channel including necessary stabilization measures.

II - Enlargement of existing channel or stream.

5/ M() - Manmade ditch or previously modified channel

N - An unmodified, well-defined natural channel or stream.

O - None or practically no defined channel.

6/ PR - Perennial - flows at all times except during extreme drought.

I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.

E - Ephemeral - flows only during periods of surface runoff, otherwise dry.

TABLE 3A - STRUCTURAL DATA

GRADE STABILIZATION STRUCTURES

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

Structure Location	Drainage Area (Sq. Mi.)	Design Capacity 1/ (CFS)	Drop (Ft.)	Type of Structure
5	1.5	86	3.0	Straight Drop Spillway

Lateral No.

1/ Based on the actual capacity of the channel.

TABLE 4 - ANNUAL COST

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

(Dollars)^{1/}

Evaluation Unit	Amortization of		Operation and	
	:	Installation Cost ^{2/}	:	Maintenance Cost : Total
Multiple-purpose				
Channels and				
Grade Control				
Structure				
		23,160	10,500	33,660
Project				
Administration				
		2,775		2,775
TOTAL				
		25,935	10,500	36,435

^{1/} Price base: 1975

^{2/} Amortized at 5 7/8 percent interest rate for 50 years.

Date: May 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

(Dollars)^{1/}

Item	: <u>Estimated Average Annual Damage:</u>			Damage Reduction Benefits
	: Without	: With	:	
	: Project	: Project	:	
<u>Floodwater</u>				
Crop and Pasture	49,805	22,910		26,895
Non-agricultural Roads and Bridges	380	90		290
<u>Subtotal</u>	50,185	23,000		27,185
<u>Indirect</u>	5,020	2,300		2,720
<u>TOTAL</u>	55,205	25,300		29,905

^{1/} Price base: Adjusted Normalized and 1975

DATE: May 1975

Table 6

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bear Swamp Watershed
Chowan and Perquimans Counties, North Carolina

(Dollars)

Evaluation Unit	AVERAGE		ANNUAL	BENEFITS1/	Average :		Benefit Cost Ratio
	: Damage Reduction	: Drainage : Secondary			: Redevelopment :		
					Total	Cost2/	
Stream Channel Work	26,915	23,565	6,315	5,025	61,820	33,660	1.8 to 1.0
Project Administration	xxxxxx	xxxxxxx	xxxxx	xxxxxx	xxxxxx	2,775	xxxxxxxxxx
TOTAL	26,915 ^{3/}	23,565	6,315	5,025	61,820	36,435	1.7 to 1.0

^{1/} Price base: Adjusted Normalized and 1975.
^{2/} From Table 4.

^{3/} In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$2,990 annually.

Date: May 1975

INVESTIGATIONS AND ANALYSES

Engineering

Before the project formulation a thorough field inspection was made of the drainage facilities in the watershed. Existing channels were found to have inadequate capacity because of siltation, woody growth and debris, and because previous improvements (1943-44) lacked the capacity to meet the needs of the present-day intensity of farming.

Using mean sea level as datum, field surveys were made of:

- (1) representative cross-sections of channels proposed for improvement;
- (2) essential data pertaining to all bridges and culverts; and
- (3) cropland elevation.

This data was used to prepare channel profiles for hydraulic design, estimate quantity of earth excavation, and determine road structure modifications. All land area and horizontal distances for the watershed were measured from a semi-controlled aerial photo mosaic.

A rainfall-runoff relationship was determined for the watershed using soil cover complex data. Forestland soils in the outer rim of the watershed normally placed in hydrologic group "B" were treated as class "C" soils because of the high ground water condition existing in this area. A curve number of 70 for the watershed was computed from this data. Using the 70 CN, the equation $C=16.39 + 14.75Re$, and North Carolina rainfall curves, a coefficient of 53 was computed to use in the drainage curve $Q=CM^{5/6}$ to obtain required discharges for all designed channels.

Field surveys and hydrologic analyses have shown that the existing swamp and channel below Lateral 5 (see project map) have adequate capacity to remove runoff water from improved channels without damages to cropland and other property. The channel below Lateral 5 may not however have adequate depth to serve on-farm drainage systems. Although out-of-bank flows below Lateral 5 occur fairly often, it was determined that the 1,000-3,000-foot wide swamp provides an ample flowage area for all discharges.

The allowable tractive forces method in Technical Release No. 25, Planning and Design of Open Channels, was used to determine the stability of the designed channels. The allowable tractive force based on field samples was above the calculated tractive force for the aged condition of all designed channels except Lateral 5. This particular channel required a grade control structure to flatten the slope, thereby meeting the tractive force criteria.

Investigation

The calculated tractive forces for the as-built conditions in the main channel will be less than the maximum allowable tractive forces, while these allowable forces will be exceeded in the laterals. Because of the flow conditions (ephemeral and intermittent), vegetation will be easily established. A field investigation revealed that channel work would be performed through a dense material with a cementing agent. It also showed that newly dug channels in this area quickly stabilized. Based on this analysis, the channels are expected to be stable.

The present project proposal will (1) terminate all channel work at Lateral 5; (2) provide sediment traps at the junction of the main with Lateral 2 and Lateral 4, and at the downstream termination point of the channel work; and (3) design main stream channel work below Lateral 2 with capacity to allow natural vegetation to be reestablished and uncontrolled.

Economics

Economic investigations and analyses were based on methods approved by the Soil Conservation Service in benefit-cost evaluation of land and water resource projects. Basic data were obtained from local farmers, agricultural workers, experiment stations, and United States Department of Agriculture publications.

Adjusted normalized prices were derived from data approved by the Interdepartmental Staff Committee, Water Resources Council on April 10, 1966.

Adjusted normalized prices were used in all benefit computations and for operations and maintenance costs. Present (1975) prices were used for installation costs. The cost of all structural measures was amortized over a 50-year period, using an interest rate of 5 7/8 percent.

Owners and operators of land to be benefited by the project, along with agricultural workers, were interviewed to determine present and future without project and future with project land use and yields. This information was summarized and compared with projected crop yields for this area. Damages to crops were based on these summaries.

The following tabulation shows the "without" and "with" project land use and yields on wet cropland in the benefited area:

<u>Land Use</u>	<u>Without Project</u>		<u>With Project</u>	
	acres	yield/acres	acres	yield/acres
Peanuts	429	2,300 lbs.	429	2,600 lbs.
Soybeans	2,380	27 bu.	2,450	33 bu.
Corn	2,460	75 bu.	2,460	85 bu.
Pasture	100	4 AUM	100	5 AUM
Idle	<u>80</u>	-	<u>10</u>	-
Total	5,449		5,449	

Floodwater damage reduction and drainage benefits to crops, pasture, and forestland were estimated on the basis of differences in net returns with and without project. The differences in net returns for corn, soybeans, and peanuts were based on increased yields and improved efficiency.

Benefits to 800 acres of forestland were based on improvement of the site index from 70 to 80. Appropriate associated costs were deducted from gross benefits. Benefits were adjusted for lag in accrual and discounted accordingly. Net benefits were credited to flood damage reduction and drainage in the same proportion as costs were allocated to the flood prevention and drainage purposes.

Road and bridge damages were based on increased maintenance costs caused by flooding. These values were adjusted to reflect conditions expected to prevail over the evaluation period without the project, in accordance with Chapter XV of the Economics Guide.

Indirect benefits were estimated to be 10 percent of the floodwater damage reduction benefits (see Table 5).

Local secondary benefits were estimated in accordance with paragraph 102.02213 of the Watershed Protection Handbook and Chapter II of the Economics Guide. The value of local secondary benefits stemming from the project was estimated to be 10 percent of the direct primary benefits (not including indirect benefits).

Redevelopment benefits were estimated in accordance with the Economics Guide and paragraph 102.02212 of the Watershed Protection Handbook. Wage payments for local labor during construction were estimated to be equivalent to 20 percent of the construction costs. This value was amortized at 5 5/8 percent interest rate for 50 years to arrive at an annual redevelopment benefit from this source. Fifty percent of the annual operation and maintenance costs was used as the value of wages paid to local labor. This value was treated as a decreasing annuity for 20 years at a 5 5/8 percent interest rate and converted to an annual equivalent over the project life.

The installation cost of multiple-purpose structural measures for flood prevention and drainage were allocated to each purpose in accordance with the method prescribed in paragraph 103.0221b of the Watershed Protection Handbook as follows:

- (1) A portion of multiple-purpose costs was allocated to flood prevention equivalent to the ratio of non-wetland to total area served by multiple-purpose channels.
- (2) The remaining costs were considered as joint costs and were allocated equally between flood prevention and drainage.

Investigation

These steps provided the following percentages:

- | | | |
|----|--|------|
| a. | Percent non-wetland is of total | 6.6 |
| b. | Percent joint cost is of total | 93.4 |
| c. | One-half of joint cost (percent) | 46.7 |
| d. | Percent cost allocated to flood prevention | 53.3 |
| e. | Percent cost allocated to drainage | 46.7 |
-
- | | | |
|-----|--|-----------|
| (3) | Estimated construction cost of multiple-purpose structural measures: | \$262,000 |
| (4) | Amount of construction cost allocated to flood prevention: | 139,646 |
| (5) | Amount of construction cost allocated to drainage: | 122,354 |

Details of cost-sharing arrangements for the multiple-purpose structural measures are as follows:

<u>Item</u>	<u>Public Law 566</u>	<u>Other</u>	<u>Total</u>
Construction Cost			
(Flood Prevention)	\$139,646	\$ 0	\$ 139,646
Construction Cost (Drainage)	61,177	61,177	122,354
Engineering Services	26,200		26,200
Project Administration:			
Construction Inspection	26,200	0	26,200
Other Services	15,700	0	15,700
Administration of Contracts	0	2,600	2,600
Land Rights	0	83,300	83,300
Total	\$268,923	\$147,077	\$ 416,000

Land Use and Treatment

Present land use was determined from soil surveys, soil and water conservation district report, and field studies. Estimates of future land use and agricultural treatment measures were made by the district conservationist on the basis of his knowledge of the land, people, and trends in the watershed area. Needed land use adjustments based on land capabilities were considered in arriving at the land treatment measures planned for the watershed.

The importance of land treatment has been stressed in every meeting with the sponsoring local organization. Every effort has been made to make them aware that benefits claimed for project justification are contingent upon the application of land treatment measures.

Forestry

A systematic field survey was made of the forested portion of the watershed to determine ground cover, forest, and hydrologic conditions, and treatment needs. This survey, supporting data and information from other agencies, and correspondence with forestry officials determined the amount and type of remedial measures needed on the watershed's forestlands.

Biology

Biologists from the United States Fish and Wildlife Service, North Carolina Wildlife Resources Commission, and the Soil Conservation Service made a joint field investigation of the watershed. Service representatives made a detailed investigation to locate a suitable site for a proposed wildlife wetland area to serve as a mitigative measure for habitat destroyed by channel work. A suitable 160-acre site was located.

The aforementioned biologists discussed ways and means of improving the fish habitat of the area. Studies indicated that overdigging about three miles of the lower portion of the main channel would assure a continuous water supply and increase fish habitat. It was also found desirable and feasible to install an access area (boat ramp and parking area).

Objections were raised by the United States Fish and Wildlife Service in review of the proposed plan. They objected to channel work below Lateral 5 (see project map) on the grounds that such work would destroy or greatly alter approximately 350 acres of forested swamp and bottom-land hardwoods along the streambank.

Therefore, the alternative to the original plan of stopping all channel work at Lateral 5 was worked out in a meeting between the North Carolina Wildlife Resources Commission, the United States Fish and Wildlife Service, and the Soil Conservation Service. This alternative eliminates approximately 3.3 miles of channel work and leaves about 350 acres of forested swamp and bottom-land hardwoods between Lateral 5 and Secondary Road 1111 undisturbed. Since this work would not be done it was also decided that 160 acres of wildlife wetland preservation, 2.6 miles of peripheral channel with fishery development, and a boating access area with a one-acre parking lot at Secondary Road 1111 would also be eliminated because there would then be no need for mitigative measures.

Sediment

A cover data survey was developed for the entire watershed. The conservation problems, erosion problems, soil fertility problems, and drainage problems were mapped. Sediment source areas, sheet erosion areas, and channel erosion problems were located.

Investigation

Sheet erosion in this watershed is not a problem due to the nearly level topography, soil types, and farming methods. As stated earlier, the 2.3 tons per acre average annual erosion rate from cropland is well below the level required to maintain future productivity. Minor amounts of sediment produced in the watershed are mostly from newly constructed ditches (before stabilization) and from numerous roadside and field ditches.

Damage from sediment is mostly from channel fill with resulting raised water tables and drowning crops. Due to the low channel gradients and to the small amount of erosion, very little sediment is delivered to the mouth of the watershed.

Geology

Numerous test holes were made by hand auger and all filed for future reference in the preliminary investigation stage. All borings were described and logged using the Unified Soil Classification System. The soil conditions revealed by this investigation indicate that bank stability will not be a problem.

Additional geologic studies were done in the spring of 1974 for the purpose of determining necessary parameters for tractive force analyses and for observing stability of existing channels. Results of these studies were used in checking the designed channels for compliance with the requirements of Technical Release 25.

Final design of the channels will be accomplished in the operation stage of the project. At that time, additional channel borings tied to vertical control will be taken to supplement the preliminary information gathered during the development of the work plan. Experience in this area and these type soils indicate that the channels may be maintained with relatively low cost.

Archaeological and Historic

An archaeological survey was contracted with the North Carolina Department of Cultural Resources, Division of Archives and History. No evidence of any sites of significant historic or architectural importance was documented in the survey.

